Stoller
Grand Junction Office established 1959

299-E33-07 (A4871)
Log Data Report

Borehole Information:

Borehole: 299-E33-07 (A4871)			Site: 216 B-50 Crib		
Coordinates (WA St Plane)		GWL (ft)[1]: 230.61		GWL Date:	09/02
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
137,695.97 m	573,574.03 m	02/55	635.44	230.6	cable tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inner Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel (welded)	2.5	8.625	8.0	0.3125	0	233
Steel (welded)	1.5	4.50	4.0	0.25	0	217

Borehole Notes:

The casing depth information provided above is derived from a well construction and completion summary obtained from Ledgerwood 1993, corrected to the current TOC. The casing size information for the 4- and 8-in. steel casings was confirmed from tape and caliper measurements collected in the field by Stoller personnel. The ground water level was measured from the TOC by Duratek well services personnel. The coordinates and TOC elevation are derived from HWIS[3].

This borehole was originally drilled in 1955. It is reported an 8-in. casing had been placed to 233 ft in depth. A 4-in.casing was introduced inside the 8-in. casing to a depth of 217 ft. The 8-in. casing was perforated and grout was placed between the 4- and 8-in casings from the surface to 217 ft in depth where a packer was set. A cement plug was placed in the bottom 3-ft of the borehole.

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	09/02	Calibration Reference:	GJO-2002-287-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 1C		Type: HRLS (planar)
Calibration Date:	03/02	Calibration Reference:	GJO-2002-309-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	09/24/02	09/25/02	09/25/02	09/26/02	09/30/02

Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth	3.0	234.0	204.0	137.0	112.0
Finish Depth	26.0	205.0	136.0	111.0	38.0
Count Time (sec)	200	100	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	0.5	1.0	1.0	1.0
ft/min	n/a[4]	n/a	n/a	n/a	n/a
Pre-Verification	BB137CAB	BB139CAB	BB139CAB	BB140CAB	BB141CAB
Start File	BB138000	BB139000	BB139059	BB140000	BB141000
Finish File	BB138023	BB139058	BB139127	BB140026	BB141072
Post-Verification	BB138CAA	BB139CAA	BB139CAA	BB140CAA	BB141CAA

Log Run	**6**	**7 Repeat**			
Date	09/30/02	09/30/02			
Logging Engineer	Spatz	Spatz			
Start Depth	39.0	42.0			
Finish Depth	25.0	67.0			
Count Time (sec)	100	200			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	n/a	n/a			
Pre-Verification	BB141CAB	BB141CAB			
Start File	BB141073	BB141088			
Finish File	BB141087	BB141112			
Post-Verification	BB141CAA	BB141CAA			

High Rate Logging System (HRLS) Log Run Information:

Log Run	**1**				
Date	10/09/02				
Logging Engineer	Spatz				
Start Depth	20.0				
Finish Depth	44.0				
Count Time (sec)	300				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	n/a				
Pre-Verification	AC042CAB				
Start File	AC042000				
Finish File	AC042048				
Post-Verification	AC042CAA				

Logging Operation Notes:

SGLS logging was performed in this borehole during September 2002 on four separate days. A zone of high gamma flux was logged with the HRLS in October 2002. Logging was conducted without a centralizer on the sondes because the borehole diameter was too small. Logging measurements are referenced to the top of the 8-in. casing. A repeat section with the SGLS was collected in this borehole to evaluate system performance.

Analysis Notes:

Analyst:	Henwood	Date:	10/21/02	Reference:	GJO-HGLP 1.6.3, Rev. 0

Pre-run and post-run verifications of the logging systems were performed for each day's log event. The verification spectra met the acceptance criteria.

Casing corrections for 0.3125 -in.- and 0.25-in.-thick casings were applied for the 8-in. and 4-in. steel casings, respectively. Where more than one casing exists at a depth the casing correction is additive (e.g., an 8-in. and 4-in. casing would be the correction for 0.3125 + 0.25 = 0.5625).

Data were acquired for 100 s at 0.5-ft depth intervals during log run 2 between 205 and 234 ft in depth rather than 200 s at 1-ft intervals in the remainder of the borehole. This change was made to reduce logging time while improving the spatial resolution of the measurements. On the basis of Ledgerwood (1993), it was presumed there was a single casing in this interval. Measurements for the gamma rays (e.g., 662 keV ^{137}Cs, 1333 keV for ^{60}Co, 1460 keV for ^{40}K and 2614 keV for ^{232}Th) appear to be adequate at the 100-s counting time. However, the naturally occurring ^{238}U as measured with either the 609-keV or 1764-keV gamma rays was not detected above the MDL at some depth locations. The cause of this lack of detection is probably due to an elevated background resulting from the existence of relatively higher ^{60}Co concentrations.

Each spectrum collected during a log run was processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL worksheet templates identified as G2Bsep02.xls and G1cfeb02.xls for the SGLS and HRLS, respectively, using efficiency functions and corrections for casing, water, and dead time as determined from annual calibrations. Dead time corrections are applied where dead times exceed 10.5 percent. Where SGLS dead time exceeds 40 percent, HRLS data are substituted. A correction for water was applied to the data below 230.6 ft in depth.

Log Plot Notes:

Separate log plots are provided for the man-made radionuclides (^{137}Cs, ^{60}Co, and ^{154}Eu) detected in the borehole, naturally occurring radionuclides (^{40}K, ^{238}U, ^{232}Th [KUT]), a combination of man-made, KUT, and dead time, and total gamma plotted with dead time. High-rate logging data collected between 20 and 44 ft are substituted for SGLS data. In addition a comparison log plot of man-made radionuclides is provided that compares data collected with Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. This plot is included to assess the possibility of movement of contaminants in the vadose zone. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, casing corrections, or water corrections. Repeat log sections for naturally occurring and man-made radionuclides are also included.

Results and Interpretations:

^{137}Cs, ^{60}Co, and ^{154}Eu were the man-made radionuclides detected in this borehole. ^{137}Cs was detected between 20 and 70 ft in depth, from 157 to 204 ft, from 212 to 222 ft, and at a few intermittent locations throughout the borehole. The maximum ^{137}Cs concentrations exist between 20 and 44 ft in depth and range in concentrations from 600 to 30,000 pCi/g. ^{154}Eu was detected between 44 and 50 ft at a maximum concentration of about 1 pCi/g. It is possible ^{154}Eu also exists in the high gamma flux interval between 20 and 44 ft but cannot be measured because of an elevated background from the high ^{137}Cs and ^{60}Co concentrations. ^{60}Co was measured almost continuously throughout the borehole below 44 ft in depth; this

radionuclide may also be present in the high gamma flux zone. The maximum ^{60}Co concentration was 11 pCi/g at 225 ft in depth. Breakthrough of contaminants to groundwater is apparent.

The KUT log profiles may not accurately reflect true concentrations of the formation because of the dual casings and grout that result in significant gamma attenuation.

A comparison log plot of data collected in 1991 by the Westinghouse Hanford Company RLS and in 2002 with the SGLS is included. The RLS concentration data (^{137}Cs and ^{60}Co) were decayed to the date of the SGLS logging event in October 2002. The maximum calibrated casing correction for the RLS in 1991 was 0.40 in., which may result in a slight under estimation of concentrations where dual casings are in place from the ground surface to about 217 ft in depth. The comparison, however, shows good agreement in the profile between the logging systems. Changes in the ^{60}Co concentrations that would indicate possible contaminant movement are shown between 105 and 110 ft, 148 and 155 ft, and between 226 and 234 ft, although this assessment should not be considered conclusive. Additional monitoring is required to determine if contaminant movement is continuing.

The repeat section indicated good agreement of the man-made radionuclides and the naturally occurring KUT.

References:

Ledgerwood, R.K. 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection,* WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Inc., Richland, Washington.

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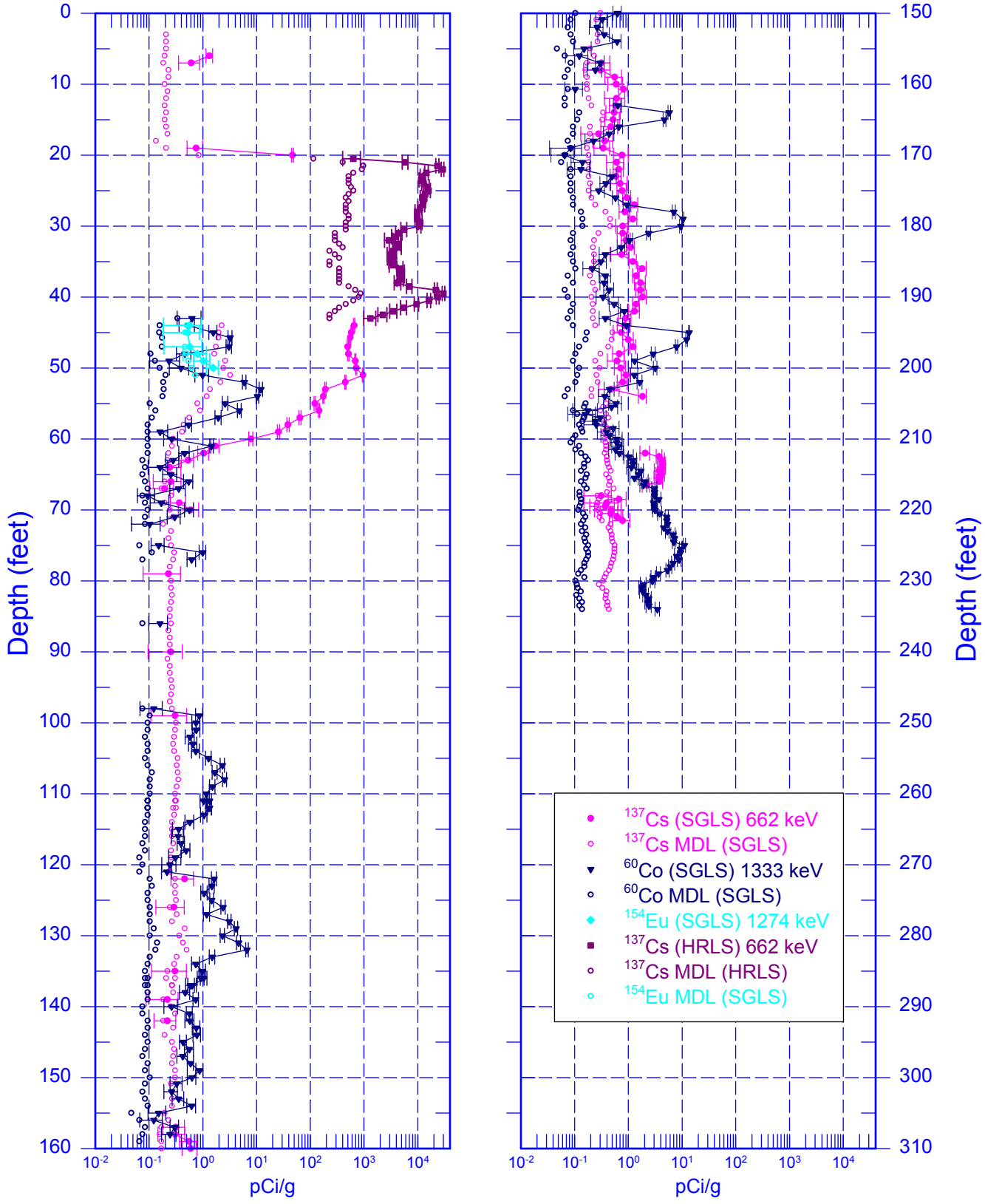
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] n/a – not applicable

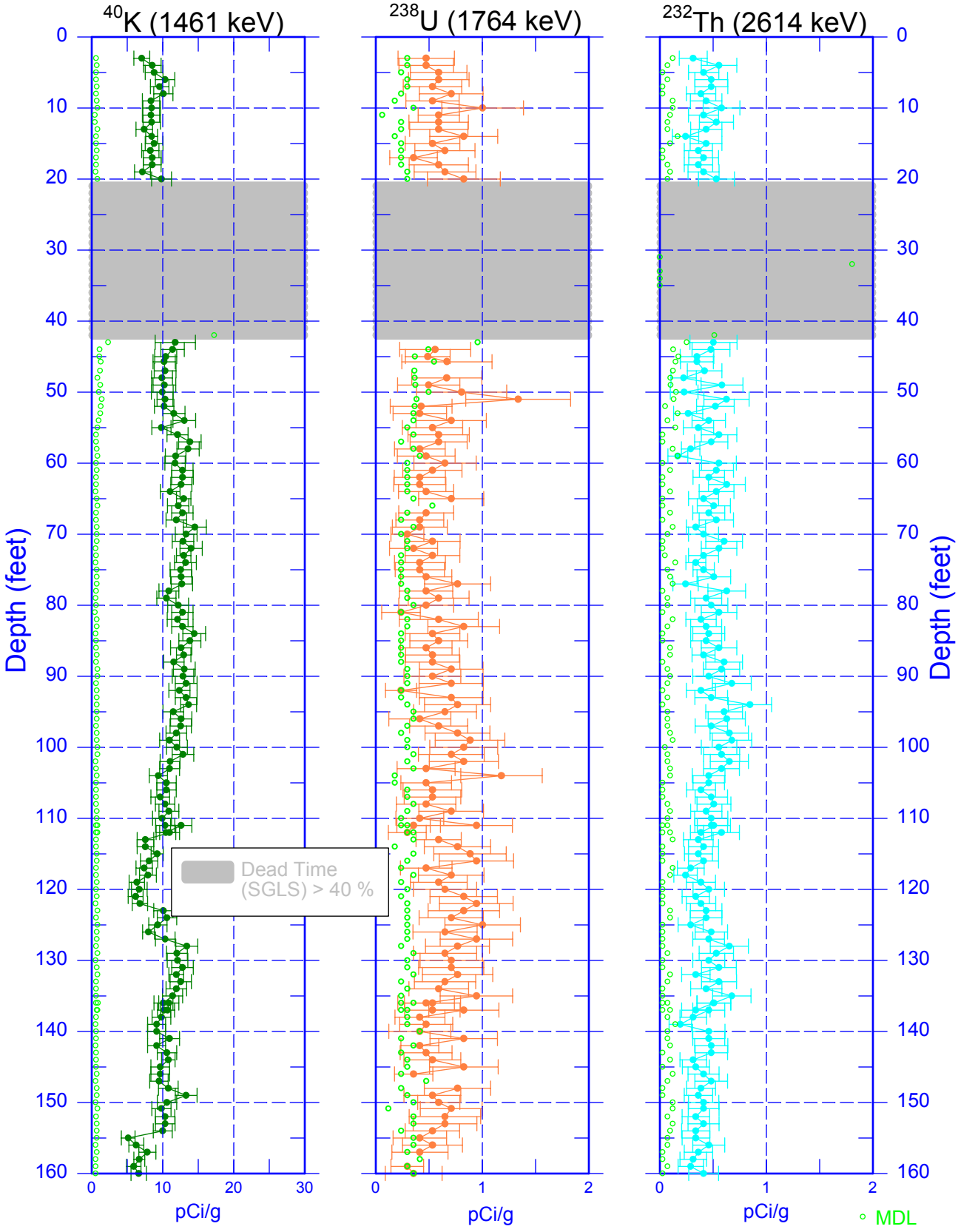
299-E33-07 (A4871)
Man-Made Radionuclides



Depth Reference - Top of Casing

Last logging date - 10/09/02

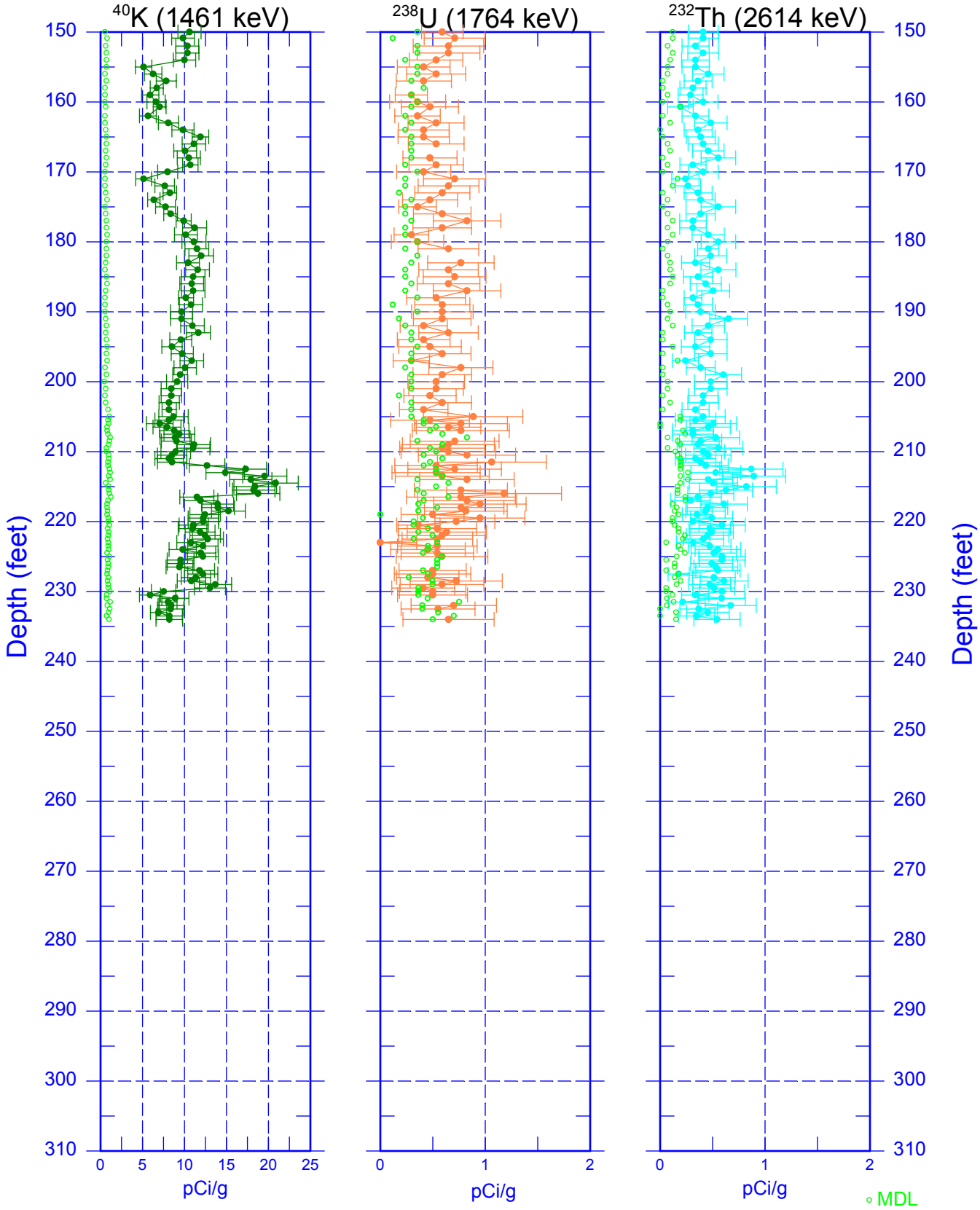
299-E33-07 (A4871)
Natural Gamma Logs



Depth reference - top of casing

Last logging date - 10/09/02

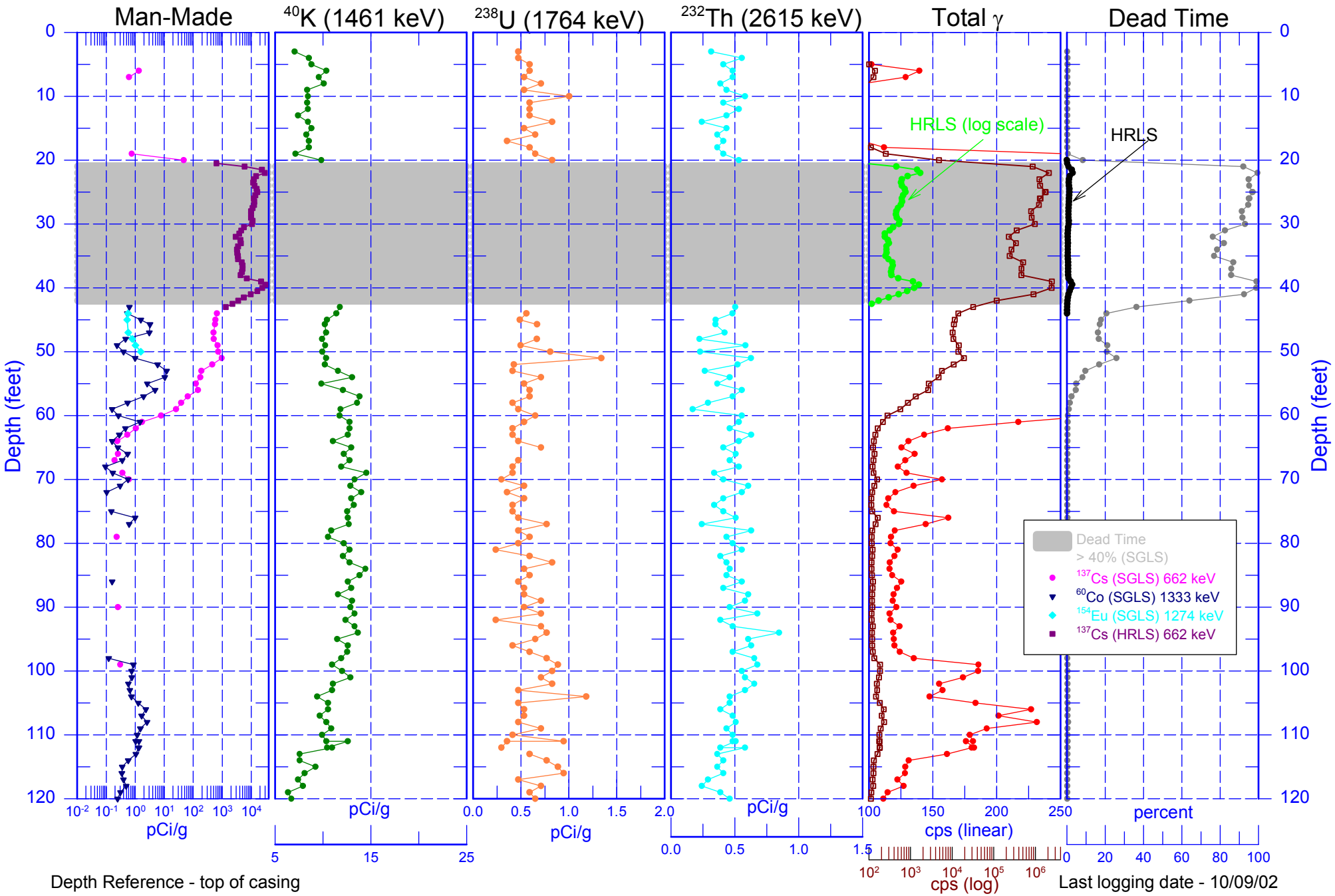
299-E33-07 (continued)
Natural Gamma Logs



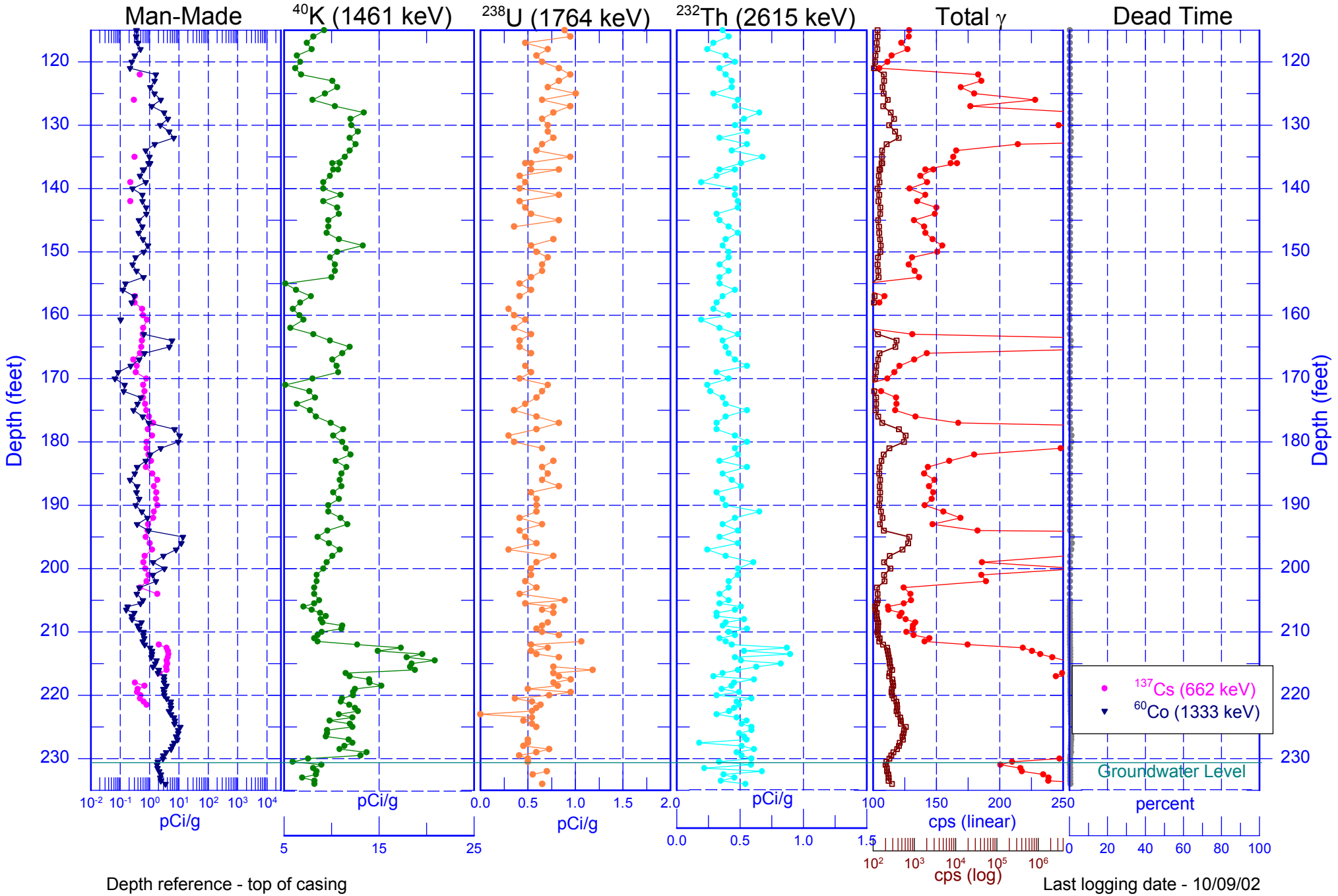
Depth reference - top of casing

Last logging date 10/09/02

299-E33-07 (A4871) Combination Plot



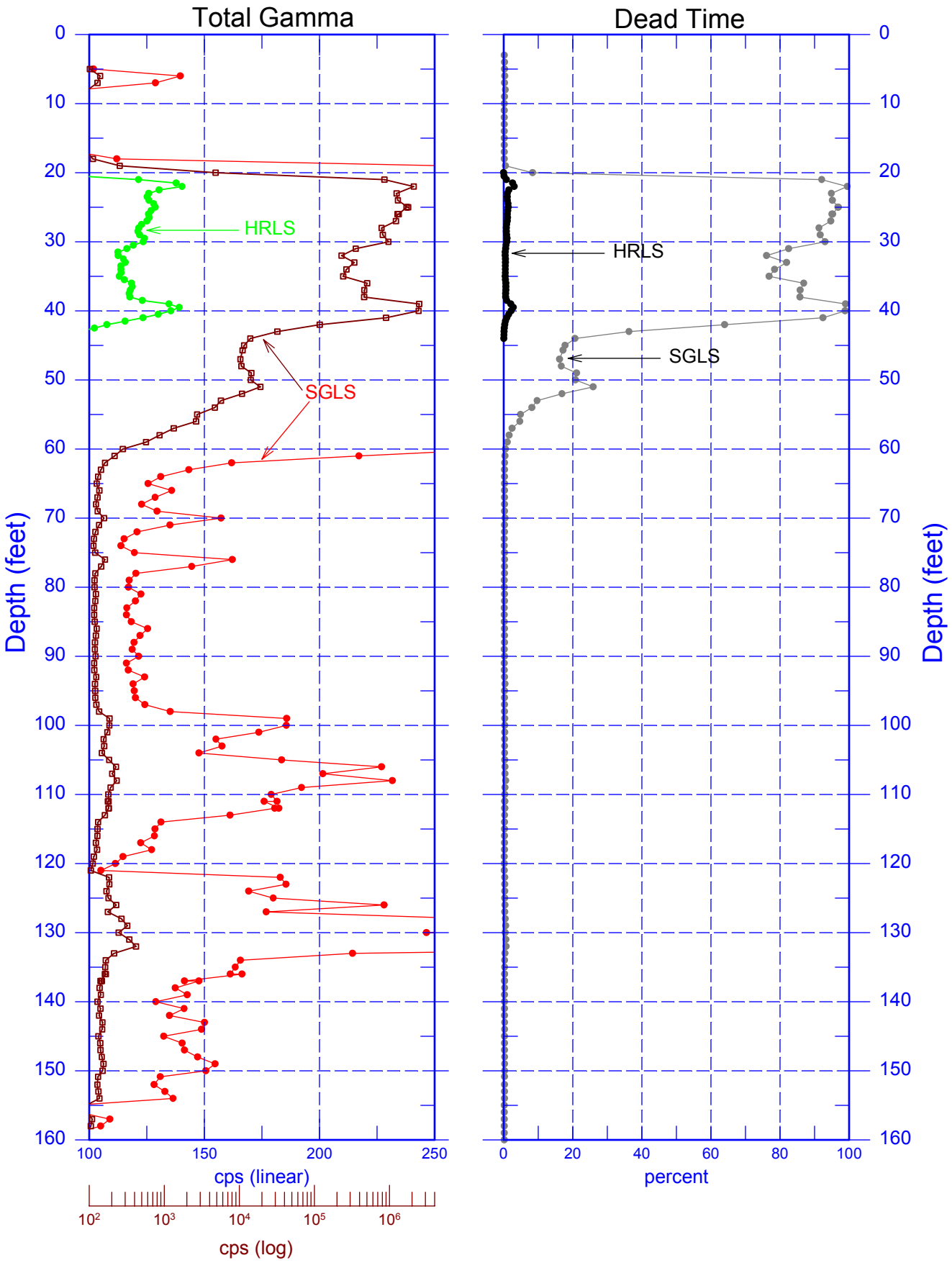
299-E33-07 (A4871) Combination Plot



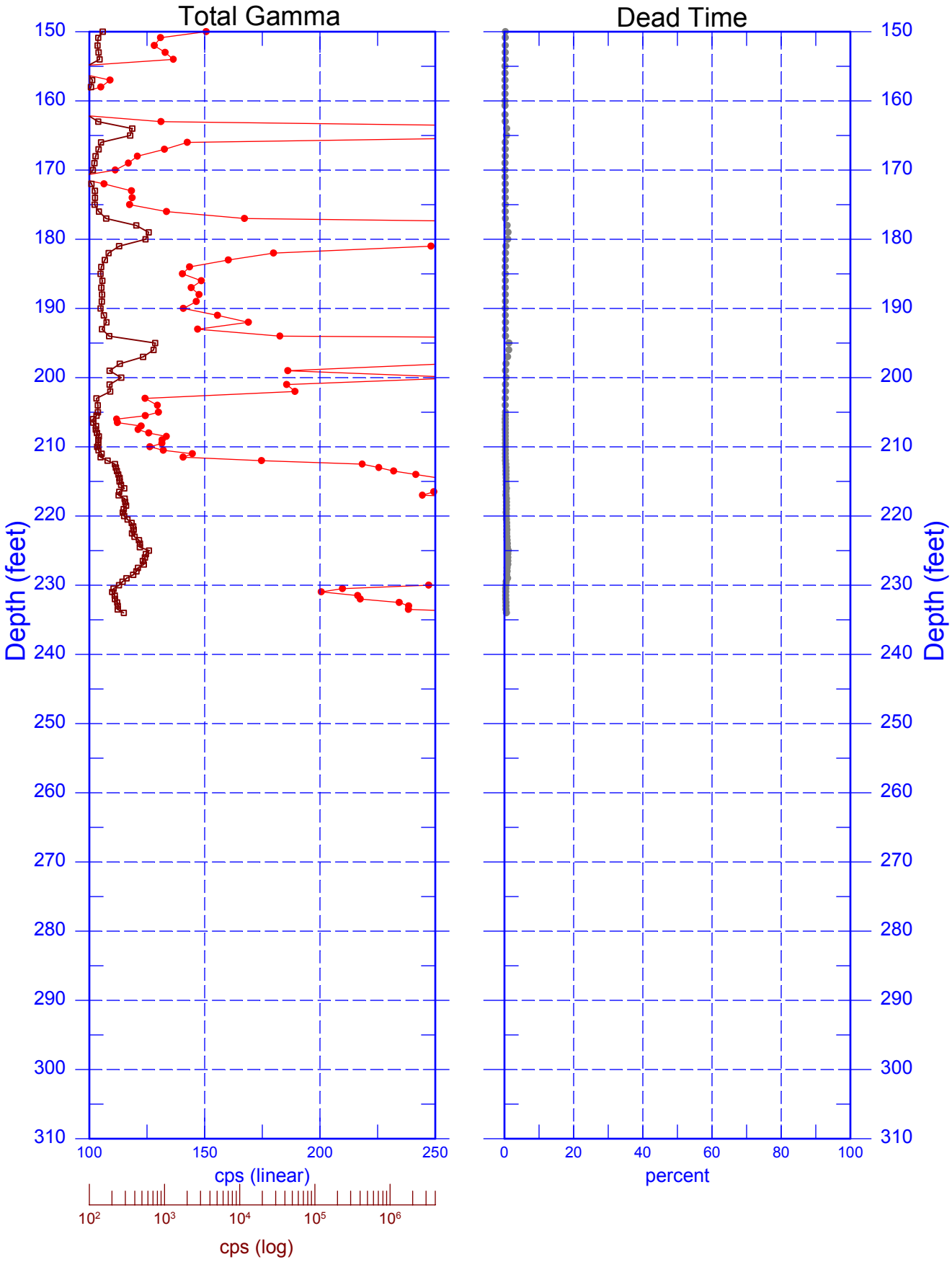
Depth reference - top of casing

Last logging date - 10/09/02

299-E33-07 (A4871)
Total Gamma & Dead Time



299-E33-07 (A4871)
Total Gamma & Dead Time



299-E33-07 (A4871)

RLS (1991) and SGLS (2002) Comparison Logs